YUMA MESA SLUDGE USE

2019

Mr. Marks,

I received the information you sent regarding the biosolids soil amendment you are land applying on the south mesa of Yuma, Arizona, including the calculation used for determining the amount of Plant Available Nitrogen (PAN) in the biosolids, and lab analyses of the biosolids. While I have not soil tested this particular field, I have experience with nearby farms. The CEC ranges from 6 – 15 in this area, meaning it moves from a sand to a loamy sand. After reviewing this information, it is my opinion that the EPA calculation used appears to be overestimating the efficiency of PAN in this region.

Recommended Ammonia Volatilization Rate

The calculation provided to determine the amount of PAN in biosolids uses an ammonia volatilization rate and nitrogen mineralization rate established in the EPA's Process Design Manual for the Land Application of Sewage Sludge and Domestic Septage assuming Midwest conditions. The ammonia volatilization rate in this calculation assumes 50% of ammonia volatilizes when surface applied to a field. This assumption is appropriate when farming in most climates in the US, but not in the hot, dry climatic and soil conditions of the field on the south mesa of Yuma and the farming practices of the farm that received the biosolids. Ammonia losses due to volatilization increase when the material is exposed to the atmosphere. When organic materials are applied to a sandy soil, the material is exposed to the atmosphere much more than in an average climate and a finer textured soil, leading to greater potential for volatilization. Exposing the organic materials to a dry and hot climate like Yuma will also lead to an increase in volatilization as compared to more temperate climates. Delays in planting and irrigating a field after applying organic materials will lead to further drying and break down of the material, another factor in volatilization rates. And a lack of acidity in the soil increases the transformation of ammonium to ammonia due to a lack of free hydrogen ions, leading to volatilization. For these reasons, I recommend using an ammonia volatilization rate between 80-90% when calculating the PAN in biosolids.

Recommended Nitrogen Mineralization Rate

The nitrogen mineralization rate in the EPA's calculation assumes 20% of organic nitrogen in anaerobic biosolids mineralizes in the first year after the application to the soil. This assumption is appropriate when farming in most climates in the US, but not in the climatic and soil conditions of the field on the south mesa of Yuma and the farming practices of the farm that received the biosolids. According to the study used to establish nitrogen mineralization rates in biosolids used by the EPA, mineralization rates in anaerobically digested biosolids vary from 4% to 48%. Mineralization rates are highest when soil moisture and temperature are adequate to facilitate the conversion of organic nitrogen to mineral forms of nitrogen like nitrate. The fields on the Yuma mesa are sands, which have limited water holding capacity provide deeper aerobic zones. Yuma's hot and dry climate results in high evaporation rates and low soil moisture. These factors will result in much lower mineralization rates than other areas in the US. For these reasons, I recommend using a nitrogen mineralization rate of 7-9% the first year of the application and 3-5% the second year.

Closing

My primary concern after looking over the information provided is that application rates could be limited based on heavy metals, instead of N mineralization rate. Further study to compare application rates and crop removal and soil samples from this site are needed.

Curtis Pate, CCA, PCA

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